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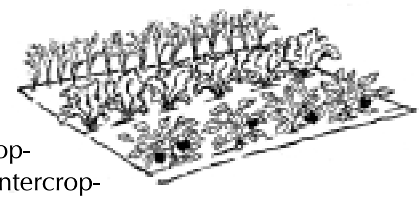
Intercropping

Agriculture and Natural Resources Fact Sheet #531



The idea behind *intercropping* (also known as *polyculture*) is growing two or more crops together in order to maximize beneficial interactions while minimizing competition. The resulting beneficial interactions can lower the need for external inputs. Intercropping can also increase biodiversity, stability, and financial diversification of your farm. Intercropping can be done with field, vegetable, and even tree crops.

Understanding Ecological Niches

The concept of ecological niches is important for understanding intercropping. An ecological niche can be thought of as both the function as well as the habitat of an organism. Plants or crops that occupy different niches are less likely to compete for the same resources (nutrients, light, water) and can thus grow together in a complementary manner.

Considerations

Successful intercropping involves consideration of the spatial arrangement, density, maturity dates, and plant architecture of the crops. A variety of spatial arrangements can be used in intercropping (see box below). Seeding rates of each crop are typically reduced to avoid overcrowding. Of course, seeding rates must also take into account desired yields for each crop. To take advantage of the differences in demands for nutrients, water, and sunlight among the individual crops, intercrops can be planted with crops having different maturity dates. Proper planning of planting dates can also minimize competition between crops, and help with staggered harvesting. Different types of plant structures of crops can be complementary. For example, corn planted with pole beans provides a climbing structure for the vines. Or tall sun-loving plants can be planted with shorter shade-tolerant plants.

Different types of intercropping.

Mixed intercropping – two or more crops grown together with no distinct row pattern

Relay intercropping– a second crop is planted into an existing crop

Row intercropping– at least one crop is planted in rows narrow enough to permit interaction.

Strip intercropping– two or more crops grown together in strips wide enough to accommodate machinery.

Allelopathy: An intercropping benefit

Allelo-*what*? Allelopathy (a-leel-o-pathy) is an interaction between plants where compounds (e.g., tannins, alkaloids, phenolic acids) produced in one plant are released into the environment and inhibit or stimulate the growth of another plant. The compounds can be released in several ways. They can be washed off leaves, leached from dry leaves, emitted from roots, or released during decomposition of the plant. It is possible to utilize allelopathic interactions in farming as a cost effective alternative to using synthetic chemical inputs and thus a means of contributing to sustainable agriculture. Allelopathy can be especially important for intercropping systems.

The ability of some cover crops to suppress weeds is due in part to allelopathy. Winter rye, for example, suppresses weed growth as it actively grows and as it decays when residues are incorporated into the soil.

An often overlooked benefit of mulches is their potential to control weeds allelopathically. Coffee chaff, almond hulls, rice hulls, apple pomace, grape skins and seeds, or walnut hulls can be spread over the soil surface or between crop rows to inhibit weeds as compounds leach from them into the soil.

Several crops themselves can inhibit certain weeds through allelopathic mechanisms including beets, lupine, corn, wheat, oats, peas, buckwheat, millet, barley, rye, and cucumber. Although further study is needed to isolate allelopathic mechansims versus mechanisms related to competition, allelopathic potential of crops offers an attractive alternative to chemical weed suppression. Such alternatives are increasingly important in the face of environmental pollution, groundwater contamination, and increased resistance of weeds to herbicides.

Measuring Productivity using LERs

One way to assess the benefits of intercropping is to measure productivity using Land Equivalent Ratio (LER). LER compares the yields from growing two or more crops together (intercropping) with yields from growing the same crops as single monocultures or pure stands. The LER equation goes like this:

intercrop1/pure crop1 + intercrop2/ pure crop2 = LER.

The resulting number indicates the amount of land needed to grow both crops together compared to the amount of land needed to grow pure stands of each. An LER greater than 1.0 usually shows that intercropping is advantageous whereas an LER less than 1.0 shows a yield disadvantage but there may be other advantages. For details on using the LER to measure productivity see Fact Sheet #532.

Companion Planting

Perhaps the most familiar intercropping combination is one used for centuries by indigenous cultures, corn, beans, and squash. This trio demonstrates many of the beneficial aspects of companion planting. The beans (legumes) fix nitrogen from the air (via a symbiotic relationship with *Rhizobium* bacteria) for their own benefit as well as that of neighboring plants like corn.

A good intercropping combination for this region is broccoli and lettuce. Lettuce matures rapidly and has a shallow root system, whereas broccoli matures slowly and has much deeper roots. The lettuce is harvested first then the broccoli can take advantage of the remaining resources. The physical arrangement of the two plants also helps conserve soil moisture (Gliessman 1998). This combination adds diversity and helps take advantage of nutrient and water resources at different levels in the soil. By occupying different niches, the two crops are complementary to each other.

Other combinations that can be tried in this region include beets, onions, and carrots grown in strips or corn planted with pumpkins. Brassicas can be planted with celery, beets, onions, chard, or spinach.

Intercropping need not be limited to crop species. Beneficial interactions often occur between noncrop species and crop species. For example, flowering buckwheat attracts many different kinds of beneficial insects.

Studies indicate that broccoli grown with a border of wild mustard can produce higher yields (Gliessman 1998). In this case, the higher yields are attributed to the preference of flea beetles to the wild mustard for forage and the resulting reduction of pest pressure on broccoli. For protection against nematodes, planting African marigolds around crops may be useful because marigolds emit a chemical that seems to repel nematodes.

Resources

Appropriate Technology Transfer for Rural Areas (ATTRA), PO Box 3657 Fayetteville, AR 72702; (800) 346-9140.

Grossman, J. and W. Quarles. 1993. “Strip Intercropping for biological control”. In *The IPM Practitioner*. April. BioIntegral Resource Center (BIRC), Berkeley, CA.

McClure and Roth. 1994. *Rodale’s Successful Organic Gardening: Companion Planting*. Rodale Press, Emmaus, PA.

Sources

Gliessman, S. R. 1998. *Agroecology: Ecological Processes in Sustainable Agriculture*. Sleeping Bear Press, Chelsea, MI.

Kuepper, G. 1998. *Companion Planting: Basic Concepts and Resources*.. Appropriate Technology Transfer for Rural Areas (ATTRA), Fayetteville, AR.

Sullivan, P. 1998. *Intercropping Principles and Production Practices*. Appropriate Technology Transfer for Rural Areas (ATTRA), Fayetteville, AR.

Alternate formats available upon request. 206-205-3100 (TTY 711)

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